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ABSTRACT

Activities to Facilitate Nonvocal Language-Communication Boards, an activity guide providing augmentative communication systems to children who cannot effectively speak, was field tested with 51 severely handicapped children (6 months to 4 years old). All had a poor prognosis for developing speech. Language development scores from standard evaluations were converted to rates of development for both expressive and receptive language. Ss were also rated on a motivation (amount of initiating behavior) questionnaire. Ss made significant gains in both expressive and receptive rates of language development. Ss with higher motivation made significantly more gains than those with lower motivation. Results indicated the guide was useful in a total educational program. The importance of motivation and of uncovering ways to increase motivation was noted. (Author/CL)

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Final Report

Grant No. G008101154

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IMPLEMENTATION OF NONVOCAL COMMUNICATION STRATEGIES WITH SEVERELY HANDICAPPED PRESCHOOLERS

U.S. Department of Education
Special Education Programs

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Final Report

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Implementation of Nonvocal Communication Strategies with Severely Handicapped Preschoolers

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U.S. Department of Education
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Abstract

The purpose of this study was to field test Activities to Facilitate Nonvocal Language - Communication Boards (Helm, 1980) with a population of children between the ages of 6 months and 4½ years old who had a poor prognosis for developing speech. Fifty one subjects were selected by the staff from the four participating agencies. The research director acted as a consultant to agencies and provided them with ideas, suggestions and materials to develop programs aimed at facilitating communication development. Emphasis was on increasing the subjects' interaction with the environment toward the goal of using an augmentative communication system.

Language development scores from standard evaluations were converted to rates of development for both expressive and receptive language (DA/CA). Subjects were also rated on a motivation (amount of initiating behavior) questionnaire. The population made significant ($p < .05$) gains in both expressive and receptive rates of language development. Subjects with higher motivation made significantly more gains than those with lower motivation.

Results indicate the Activity Guide is useful in a total educational program. An implication from the findings was that motivation (initiating behavior) is a very important characteristic which allows children to be available to change. More research and development is needed to facilitate change in motivation.

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Implementation of Nonvocal Communication Strategies With Severely Handicapped Preschoolers

Introduction

The purpose of this study was to field test Activities to Facilitate Nonvocal Language - Communication Boards (Helm, 1980), (referred to as the Activity Guide). The subjects studied were a group of handicapped preschoolers between the ages of 6 months and 4½ years of age who had a poor prognosis for speech development. The activities were selected from the normal sequence of language/communication development and were modified to facilitate nonvocal (augmentative) communication.

Over the last 15 years the importance of providing augmentative communication systems to children who cannot effectively speak has been increasingly recognized (see Silverman, 1980, for over view). Numerous studies have demonstrated the value of this approach (McDonald and Schultz, 1973; Vicker, 1975; Fristoe and Lloyd, 1978; Schiefelbusch, 1980; Silverman, 1980). A wide variety of gestural (American Sign Language, American Indian Sign Language, pantomime, hand signals) and gestural-assisted (communication boards, modified typewriters, synthetic voice producers, etc.) augmentative communication modes have been used. For examples of this research, see McDonald and Schultz, 1973; Vicker, 1975; Elder and Bergman, 1978; Hagen, et.al. 1973; Vanderheiden, D.H., 1975; Reich, 1978; Morris, 1975; Schiefelbusch, 1980; Shane, 1981; and for overview, Silverman, 1980.

Criteria for entry into the above augmentative communication programs have varied, but a primary one has been the failure of speech development. Most of the studies have been with children older than 5 years of age (Silverman, 1980). Other criteria have included a 5 minute attention span, 5th or 6th stage of

Piaget's sensorimotor period, 2 year old cognitive level or a 2 year old receptive language level with significantly lower expressive skills.

This study proposed to investigate the value of augmentative communication programming with a population of very young children (6 months to 4½ years old) who had a poor prognosis for speech development. The need for such a study has been stated in the literature (for example, Harris and Vanderherden, 1980).

The young population was selected in an effort to provide augmentative communication programming before speech failure (or the inability to effectively communicate) becomes an integral part of these children, an effort to facilitate an effective communication system as language and cognitive skills emerge.

For the purposes of this study augmentative communication is defined as any system or mode of communication other than speech. "Augmentative" is used rather than non-speech or non-vocal to emphasize that our goal was to facilitate optimal communication not replace speech. Modes emphasized were communication boards and sign language.

The focus was to provide programming ideas for children in the pre-linguistic and emerging language periods of development. For many children in the study emphasis was placed on pre-linguistic communication development, stressing modeling and preparation for use of a nonvocal system. Children who were ready to begin (or had begun) the initial stages of intentional expressive language, were introduced to a workable communication system. For all children, efforts to improve oral motor control and to develop speech continued. The study complimented to total educational programs in which the children were already enrolled. The research study had the following objectives:

1. To field test Activities to Facilitate Nonvocal Language-Communication Boards with a population of children from ages 6 months to 4½ years of age whose prognosis was poor for speech development.

2. To provide teachers, therapists and parents with ideas for development of programs and materials to facilitate nonvocal communication with their children.

3. To determine if the sequence of normal language development as utilized in the Activity Guide was an effective means to help develop nonvocal communication.

4. To address the following research questions:

   a. Were there significant differences ($p. < .05$) in the rate of language development pre and post treatment as measured by standard evaluations and analyzed by a t-test?

   b. Did children in educational programs during the year prior to this research make significantly ($p. < .05$) more gains in their rate of language development this year compared to the prior year?

   c. Did the younger children (younger than the mean age) make significantly different ($p. < .05$) gains in their rate of language development when compared to the older children in the study?

   d. Were there significant differences ($p. < .05$) in the rate of language development, pre and post treatment, for children with comparatively high, moderate or low levels of motivation?

   e. Did children with high or low rates of development (above .50 and below .30 DA/CA respectively) make significantly ($p. < .05$) different gains in rate of language development pre and post treatment?

   f. Did children in programs mandating parent participation make significantly different ($p. < .05$) gains in rate of language development pre and post treatment?

Methods

This section will briefly characterize participating sites, discuss subject selection, begin subject descriptions and delineate the research procedure.

Four local (to the Washington, D.C. area) school systems, 2 public and 2 private, agreed to participate in the research study. There were 7 participating sites and children were located in 18 different classes (one of which was a home-based program). Sixty two children were identified by participating sites as appropriate for the study. Fifty one children completed the year as subjects for the research. (Ten children moved and one died.)

Guidelines presented to participating staff for subject selection were: 1) children between the ages of 6 months and 4½ years old (54 months) as of January 1, 1982, and 2) children who had failed to develop speech or who had a poor prognosis for developing speech (due to oral motor involvement, severe lack of vocal or expressive language, severe retardation, etc.). Parent permission to participate was secured for all children.

Subject age range as of 10-81 was 12 months to 52 months and the mean age was 32.23 months. All the children had diagnosed handicaps. The varieties included: profound retardation, severe retardation, moderate retardation, cerebral palsy, deaf-blind, emotionally handicap, William's Syndrome, Down's Syndrome, development delay and most children had multiple handicaps. The large majority had cerebral palsy of varying severity with some degree of retardation or developmental delays. Most children could be characterized as severely, multiply handicapped. (See the results section for further description of subjects.)

Participating staff continued with regular duties of assessment, planning, and programming. The Research Director acted as a consultant to staff. He worked through the speech therapists and often directly with the teachers. Visits were made regularly on a bi-weekly basis with occasional variations (once a week or several days in a row) as needed.

The children's skills and developmental levels were assessed by participating staff. Assessments to determine language levels were primarily the following: REEL, Early LAP, Infant Scale of Communicative Intent and the Carolina. Scores were obtained for all subjects by mid-October 1981 and again at the end of May, 1982.

The Research Director evaluated all children, with the help of participating staff and parents, on the Criterion Referenced Instrument and a

Motivation Questionnaire (both developed for this study from the Activity Guide). The Research Director also observed all children with the purpose of gaining information about communicative style, context and interest.

From all the evaluations the Research Director developed a Communication Profile for each child. This narrative included scores on all evaluations, strengths and weaknesses of communication skills, general goal suggestions and specific program and material suggestions directed toward augmentative communication development. Specific program suggestions were developed from the Activity Guide.

Profiles were given to participating staff and suggestions were discussed. Some suggestions were already being implemented and many others were added to or replaced existing program plans. This was done at the discretion of participating staff. (This was in compliance with entry agreements and assurances that children would only receive programming that those responsible for their education believed most appropriate.)

Ongoing meetings and observations were conducted throughout the year. The Research Director made and modified materials (communication boards, switches, adapted toys) discussed programs and goals, consulted on programs for older children, presented workshops on making and modifying toys (for both staff and parents), kept data and observational notes and conducted a sub-study on expressive language programming. (The sub-study is discussed in a later section and reported in Appendix B.)

The Criterion Referenced Instrument (developed for this study) was used to suggest activities from the Activity Guide; the Motivation Questionnaire was used both to suggest activities and to characterize the children's observed motivation to communicate with the environment (both physical and social environment).

The initial and final standard evaluations administered by participating staff were used as data marking entry and exit skills. Data were also collected from records on children who had been in an educational program the year prior to the project year (in educational programs during the 1980-81 school year). Beginning (October 1980) and end (May, 1981) of year scores were collected on these 22 children.

Sample Communication Profiles and sample program suggestions can be found in Appendix A. The Activity Guide - Activities to Facilitate Nonvocal Language Communication Boards is copyrighted material and presently being revised. It is not included in this report but information is available from the Research Director, James M. Helm.

Results

This section will present the results of the study. It will be divided into several sections: data collected, description of subjects and data analysis related to each research question.

Data Collected

Data were collected on 51 children. The following is a list of information compiled. As stated above these data were used to profile each subject's communication level and style, to develop program goals and to recommend materials for communication development. A sample of profiles and recommendations can be found in Appendix A.

1. Birthdate
2. Pre-treatment scores for expressive and receptive language as of 10-81. These were from evaluations administered by participating staff; instruments used included: REEL, Early LAP, Infant Scale of Communicative Intent and the Carolina.
3. Criterion Referenced Instrument - developed from the Activity Guide, administered by Research Director and participating staff by 10-81.
4. Motivation Questionnaire - developed for this study, administered by Research Director, participating staff and Parents, completed by 10-81.

5. Post-treatment scores for expressive and receptive language as of May 1982, from standard evaluations as listed in #2, administered by participating staff.

6. Scores for expressive and receptive language as of October 1980 and May 1981 for the 22 children who were in educational programs during the year prior to this research. Scores obtained from records, participating staff had administered the evaluation, instruments used were REEL and Early LAP.

Scores for expressive and receptive language levels, obtained from standard evaluations, were converted into rates of development or performance discrepancies by dividing developmental age by chronological age (DA/CA). This was done for each of the 51 subjects; in other words, a rate of development was calculated for expressive and receptive language pre and post treatment for each subject (102 pre-treatment scores, 102 post-treatment scores). The conversion to rates was calculated so the change in the rate of development could be compared pre and post treatment.

By using rates the maturation factor is also addressed. With severely handicapped children the rate of development often decreases even though progress continues. Rates allow us to examine the amount of gains and to compare the pre and post treatment ratios of development to chronological age.

Description of Subjects

There were 51 subjects with an age range of 12-52 months (as of October 1981). The mean age was 32.23 months. The variety of diagnosed handicaps was considerable, as described in the Method section. The subjects could be characterized as multiply handicapped.

As of October 1981, the mean rate of expressive language development was .2757 (or 8.89 months) and the mean rate of expressive language development was .3378 (or 10.89 months). In general they were severely handicapped.

Tables 1, 2 and 3 summarize the subjects in this study. Table 1 characterizes the entire research sample as to pre-and post-treatment age (mean: 32.23 months, range: 12-52 months), rate of language development (expressive rate:

pre-treatment .2757, post-treatment .3237; receptive rate: pre-treatment .3378, post-treatment .3935) and developmental levels in months (expressive: pre-treatment 8.89 months, post-treatment 12.70 months; receptive: pre-treatment 10.89 months, post-treatment 15.43 months).

Table 2 divides the subjects into two groups by age: a) subjects younger than the mean age of 32.23 months, N=25 and b) subjects older than the mean age, N=26. There are characterized on the same variables as the entire population in Table 1.

Table 3 divides the population into 3 groups according to their relative motivation levels: high, moderate or low motivation. Subjects are characterized as to pre-and post-treatment age, developmental rate and level in months. Levels of motivation were determined from the Motivation Questionnaire (developed for this study). Motivation was determined by the amount of interaction initiated by children in a variety of situations. These ratings are meant as a comparison, within the study, of relative initiation and do not infer intrinsic drive or any other definition of motivation.

Table 4 summarizes the characteristics of the 22 children who were in educational programs during the year prior to this study (1980-1981 school year). This table gives the mean age, rate of development and development level in months at 4 times (October 1980, May 1981, October 1981, May 1982).

Table #1. Pre- and Post-Treatment Characterization of Entire Research Sample

Pre-Treatment, October 1981

Age Range	Mean Age	Mean Rate	Mean Development in Months	Range of Rates
12-52 mo.	32.23 Mo.			
S = 15.34 mo.	Expressive:	.2757 S=.1359	8.89 mo.	.03 - .55
	Receptive:	.3378 S=.1706	10.89 mo.	.07 - .81

Post-Treatment, October 1982

19-59 mo.	39.23 mo.			
	Expressive:	.3237	12.70 mo.	.08 - .83
	Receptive:	.3935 S=.2120	15.43 mo.	.08 - .96

Mean Change of Rate	Mean Change in Months	Range of Rate Change
Expressive: .0480	3.81 months	- .16 to .39
Receptive: .0557	4.54 months	- .16 to .31

Motivation: High = 14
Moderate = 19
Low = 18

Table 2. Pre- and Post-Treatment Characterization of Younger Half and Older Half of Research Sample (Younger and Older than Mean Age of 32.2? months)

Younger Half: (32 months or less as of October 1981)

Pre-Treatment, October 1981, N=25

Age Range	Mean Age	Mean Rate	Mean Dev. in Months	Range of Rate
12-32 mo.	24.20 mo.			
	Expressive	.3284	7.95 mo.	.11 - .54
	Receptive	.3840	0.29 mo.	.11 - .81

Post-Treatment, May, 1982

19-39 mo.	31.20 mo.			
	Expressive	.3892	12.14 mo.	.14 - .83
	Receptive	.4580	14.29 mo.	.17 - .96

	Mean Change of Rate	Mean Change in Months	Range of Rate Change
Expressive	.0608 S=.1211	4.19 mo.	-.16 - .39
Receptive	.0740 S=.0905	5.00 mo.	-.16 - .31

Motivation: High = 18, Moderate = 9, Low = 8

Older Half: (33 mo. or older as of October, 1981)

Pre-Treatment, October 1981, N=26

Age Range	Mean Age	Mean Rate	Mean Dev. in Months	Range of Rate
33-52 mo.	39.96 mo.			
	Expressive	.2250	8.99 mo.	.03 - .55
	Receptive	.2896	11.57 mo.	.07 - .63

Post-Treatment, May, 1982

40-59 mo.	46.96 mo.			
	Expressive	.2608	12.25 mo.	.08 - .77
	Receptive	.3315	15.55 mo.	.08 - .77

	Mean Change of Rate	Mean Change in Months	Range of Rate Change
Expressive	.0358 S=.0683	3.26 mo.	-.04 - .22
Receptive	.0419 S=.0710	3.99 mo.	-.07 - .31

Motivation: High = 6, Moderate = 10, Low = 10

Table #3 Pre and Post Treatment
Characterization of Subjects Divided
by Motivation Levels

	MOTIVATION		
N=	High 14	Moderate 19	Low 18
Pre Treatment: October 1981			
Age Range	17-40 months	16-52 months	12-51 months
Mean Age	31.00 months	33.84 months	31.50 months
Expressive Rate	.3957	.2616	.1972
Expressive Rate Range	.15-.54	.09-.65	.03-.42
Receptive Rate	.5045	.3289	.2177
Receptive Rate Range	.21-.81	.16-.54	.07-.42
Development in Months:			
Expressive Language	12.27 months	8.85 months	6.21 months
Receptive Language	15.64 months	11.13 months	6.86 months
Post Treatment: May 1982			
Age Range	24-47 months	23-59 months	19-58 months
Mean Age	38.00 months	40.84 months	38.50 months
Expressive Rate	.4671	.3384	.1967
Expressive Rate Range	.21-.77	.16-.54	.08-.41
Receptive Rate	.5964	.3974	.2261
Receptive Rate Range	.41-.94	.17-.96	.08-.62
Development in Months:			
Expressive Language	17.75 months	13.82 months	7.57 months
Receptive Language	22.66 months	16.23 months	8.70 months
Mean Change in Rate:			
Expressive Language	.0714	.0768	-.0005
Receptive Language	.0919	.0685	.0084
Mean Change in Months:			
Expressive Language	5.48 months	4.97 months	1.36 months
Receptive Language	7.02 months	5.10 months	1.84 months

Table #4 Characterization of the 22 Children who were in Educational Programs during the year prior to this study

Date	October '80	May '81	October '81	May '82
Mean Age	25.9 months	32.9 months	37.9 months	44.9 months
Expressive Rate	.2777	.2700	.2555	.2659
Receptive Rate	.3341	.3236	.3214	.3391
Development in Months:				
Expressive Language	7.19 months	8.88 months	9.68 months	11.94 months
Receptive Language	8.65 months	10.65 months	12.18 months	15.23 months

N=22

Motivation: As of October, 1981 - High=4 Moderate=9 Low=9

Charts #1, 2, 3, 4 show the spread of pre- and post-treatment expressive and receptive language rates. Chart 1 shows this for all subjects; Chart 2 shows the population divided by age above and below the mean; Chart 3 divides the population by motivation level; and Chart 4 shows the spread for children in a prior educational program. Charts are found at the end of the Results section.

Data Analysis for Each Research Question

Question #1

Were there significant differences (p. / .05) in the entire population's pre- and post-treatment rate of expressive and receptive language development?

Rate of expressive and receptive language development was calculated for each subject pre- and post-treatment (see Table #1 for summary). The mean rate change for expressive language was .0480 and the mean rate change for receptive language was .0557. A t-test for dependent samples was performed to analyze the rate changes. The t value for expressive rate change was t=3.46 (df=50, p / .001) and the t value for receptive rate change was t=3.87 (df=50, p/ .001). There were significant changes pre- and post-treatment for both the rate of expressive language development and the rate of receptive language development.

Question #2

Did children in educational programs during the year prior to this research make significantly (p. / .05) more gains in their rate of language development during the research year compared to the prior year?

Twenty two children were in programs during the prior year (1980-1981 school year). The group is characterized in Table #4. The mean change of rate in expressive language during the prior year was -.0077; the mean change of rate in receptive language during that year was -.0105. The mean change of rate in expressive language over the research year was .0104; the mean change of rate in receptive language was .0177. The change of expressive and receptive language rates were combined for each year with the resultant change of rate for 1980-1981 equal to -.0091 and the change of rate for the research year

(1981-1982) equal to .0141. A t-test for dependent samples was used to analyze the change in combined rates. The t value was t=1.80 (df=21, $p < .07$). The change in rate of language development during the prior year compared to the change in rate of language development during the research year was not significant at the $p < .05$ level.

Several other analyses of this data were computed. The change in rate of language development during the prior year was analyzed using a t-test for dependent samples. The significance level was $p < .23$, not significant at the $p < .05$ level. The change in rate of language development pre- and post-treatment was analyzed using a t-test for dependent samples. The significance level was $p < .08$, not significant at the $p < .05$ level.

This subgroup of 22 children was compared to the total sample to determine whether or not they were significantly different in any way other than just having been in an educational program for 2 years. Their mean age as of 10-81 (37.9 months) was compared to the total mean (32.23 months); their pre-treatment rates of development (exp.: .2555; rec.: .3214) were compared to the total sample's mean rates (exp.: .2757; rec.: .3237); and the distribution of high (4), moderate (9) and low (9) levels of motivation was compared to the distribution in the total sample (H=14, M=19, L=18). A z-score for differences between means was calculated for the differences of mean ages ($p < .11$) and for the differences between rates of language development ($p < .24$). The distribution of motivation ratings was almost the same. No significant ($p < .05$) differences existed between the two groups except for the number of years in educational programs.

One noteworthy observation is that even though the change in developmental rates for these children during the study was not significant at the $p. < .05$

level, during the research year the trend of negative changes in rates was reversed. A positive rate change occurred during the research year.

Question #3

Did the younger children (younger than the mean age of 32.23 months) make significantly different (p. < .05) gains in their rate of language development when compared to the older children?

There were 25 subjects younger than the mean age of 32.23 months (as of 10-81) and 26 subjects older than the mean age. The younger group had a change in their rate of expressive language equal to .0608 and a change in their rate of receptive language development equal to .0740. The older group had a change in their rate of expressive language development equal to .0358 and a change in their rate of receptive language development equal to .0419 (see Table #2). A t-test for independent samples was used to compare the change of rates between the two groups. The t value when comparing the changes in rate of expressive language development was t=.87 (p < .20). The t value when comparing the changes in rate of receptive language development was t=1.42 (p < .08). Therefore, the pre/post-treatment change in rate of language development for the younger group was not significantly different P < .05) than the change in rate of language development for the older group. Although the younger group had greater changes in both expressive and receptive language development, the changes were not significantly greater than the changes which occurred in the older group.

Question #4

Were there significant differences (P. < .05) in the rate of language development, pre- and post-treatment, for children with comparatively high, moderate, or low levels of motivation?

As stated above, levels of motivation were determined from a Motivation Questionnaire administered by the Research Director. Some participating staff and parents helped complete the questionnaire and some were interviewed for this

purpose. The questions were aimed at determining how much and in what circumstances each child initiated behavior. This initiation could be toward the physical environment (i.e., to play with toys, investigate surroundings, etc.) or the social environment (i.e., call adults, ask for help, etc.). The ranking of high, moderate or low was determined by the obtained scores on the questionnaire. The term motivation is used here as initiation of behavior and does not imply behavior or drives attached to other definitions of the concept.

Results from the Motivation Questionnaire yielded the following distribution: 14 children high motivation, 19 children moderate motivation and 18 children low motivation. See Table #3 for population characterization according to this division.

The high motivation group (High) had a change in rate of expressive language development equal to .0714 and change in rate of receptive language development equal to .0919. The moderately motivated group (Moderate) had a change in rate of expressive language development equal to .0768 and a change in rate of receptive development equal to .0685. The low motivation group (Low) had a change in rate of expressive development equal to -.0005 and a change in rate of receptive development equal to .0084.

A t-test for independent samples was used to compare between groups the change in rate of development. A comparison of the change in rate of language development (expressive and receptive rates combined) between the High and Low groups yielded a t value of $t=3.52$ ($df = 52$, $P < .001$). A comparison of the change in rate of language development (expressive and receptive rates combined) between the Moderate and Low groups yielded a t value of $t=3.30$ ($df = 72$, $P < .001$). And a comparison of the change in rate of language development (expressive and receptive rates combined) between the High and Moderate groups

yielded a t value of t=.24 (df = 54, $p < .40$) The pre-post treatment rate of language development of the High and Moderate groups changed significantly ($p < .05$) more than the rates changed for the Low group. There was no significant difference ($p < .05$) in the amount of rate change between the High and Moderate groups.

Several internal evaluations were computed to analyze if these groups differed in ways other than just motivation level. The High group's rate of expressive language development changed significantly pre and post treatment ($p < .0025$) as did their rate of receptive language development ($p < .001$). The Moderate group's rate of expressive language development changed significantly pre and post treatment ($p < .0035$) as did their rate of receptive language development ($p < .0035$). The Low group's rate of expressive language development did not change significantly pre and post treatment $p < .48$) nor did their rate of receptive language development ($p < .33$). The High and Moderate group's rate of language development changed significantly ($p < .05$) pre and post treatment, while the Low group's did not.

The mean ages for the 3 groups were very similar. The pre-treatment rates of development varied in descending order with High groups having the highest rates and the Low group having the lowest rates. A statistical comparison of these pre-treatment rates indicated significant differences ($p < .05$). See Table #5 for complete listing of statistics. As a summary of these analyses the High motivation group had significantly higher pre-treatment rates of development than did the Moderate or Low groups. The Moderate motivation group had significantly higher pre-treatment rates of development than the Low group.

In summary, the 3 groups were similar in age but significantly different in their pre-treatment rates of development with the High, Moderate and Low groups having the highest, middle and lowest scores respectively. The High and

Moderate groups had a significant change of rate pre/post treatment, the Low group did not. And the High and Moderate groups changed significantly more, pre/post treatment, than the Low group. The High and Moderate groups did not change significantly more than the other.

Question #5

Did children with a high or low rate of language development (above .50 and below .30 DA/CA respectively) make significantly (p. $<$ .05) more gains in development pre and post treatment?

The above discussion clearly points out the general tendency that children with higher developmental rates did make significantly (p. $<$ .05) more gains pre-post treatment than those with lower developmental rates.

To analyze this question further the data were analyzed in several other ways. The data of all children who had a pre-treatment .50 developmental rate in either expressive or receptive language were compiled. There were 8 children in this group (6 had High motivation, 2 had Moderate motivation). They made significant gains (p . $<$ .012) when expressive and receptive rate changes were combined. Expressively their gains were at the p. $<$ .05 level but receptively their gains were at p. $<$ .07 level. Two of these 6 children made negative gains in their rate of expressive and receptive development and 2 made negative gains in one area; only 4 made positive gains in both areas.

Of the 18 children who made at least a .10 increase in either expressive or receptive language development, 4 had at least one rate of .50 pre treatment and 5 had rates in both areas under .30. Eight had High motivation; 8 had Moderate motivation; and 2 had Low motivation. These distributions are not significant at the p. $<$ .05 level but add support to previous findings that children with higher rates of pre treatment development and with higher (High or Moderate) motivation tended to make more gains.

Data were also divided to make groupings of subjects who made 1) any increase in one area of development equal to mean changes (.05 expressive or .06 receptive) and 2) had a .15 gain in one area. In both groups subjects with higher development and with higher motivation were represented more. Another interesting finding was that as the groupings demanded a greater amount of rate increase, the mean ages for these groups decreased.

Generally children with higher rates of language development made significantly (p. $<$ .05) greater gains pre-post treatment than did children with lower rates of development.

Question #6

Did children in programs mandating parent participation make significantly different (p. $<$ .05) gains in rate of language development pre and post treatment?

Only one program mandated parent participation and there were only 6 subjects in that group. An evaluation of this group's data showed they were almost exactly the same as the data for the total population. No significant differences (p. $<$ .05) were found. Because of the small sample size, no conclusions will be made comparing the effectiveness of the Activity Guide between programs mandating parent participation and those not having this mandate.

Table #5 Table of Statistics

1.	Entire population	
	a. pre/post treatment change of expressive rate	p. < .001*
	b. pre/post treatment change of receptive rate	p. < .001*
2.	Subjects in program prior to research year	
	a. change in rates (expressive and receptive) prior year compared to research year	p. < .07
	b. change in rates (expressive and receptive) prior year	p. < .23
	c. change in rates (expressive and receptive) research year	p. < .08
	d. age difference compared to total population	p. < .11
	e. Rate difference pre treatment from total population	p. < .24
3.	Groups younger and older than the total mean	
	a. for younger group	
	i. change in expressive rates	p. < .0062*
	ii. change in receptive rates	p. < .0010*
	b. for older group	
	i. change in expressive rates	p. < .0040*
	ii. change in receptive rates	p. < .0052*
	c. comparative change of expressive rates, younger vs. older	p. < .20
	d. comparative change of receptive rates, younger vs. older	p. < .08
4.	Groups determined by relative motivation level - High [H], Moderate [M], Low [L]	
	a. change in expressive rates for H group	p. < .0025*
	receptive rates for H group	p. < .001*
	b. change in expressive rates for M group	p. < .0035*
	receptive rates for M group	p. < .0035*
	c. change in expressive rates for L group	p. < .48
	receptive rates for L group	p. < .33

d. change in combined expressive and receptive rates:	H vs. L	p. < .001*
	H vs. M	p. < .40
	M vs. L	p. < .001*

e. difference in pre treatment rate levels

i.	expressive	H vs. total	p. < .001*
ii.	receptive	H vs. total	p. < .001*
iii.	expressive	M vs. total	p. < .36
iv.	receptive	M vs. total	p. < .39
v.	expressive	L vs. total	p. < .001*
vi.	receptive	L vs. total	p. < .001*
vii.	expressive	H vs. M	p. < .001*
viii.	receptive	H vs. L	p. < .001*
ix	expressive	M vs. L	p. < .039*
x.	receptive	H vs. M	p. < .001*
xi	receptive	H vs. L	p. < .001*
xii	receptive	M vs. L	p. < .0016*

* Significant at least at the p. < .05 level

Chart #1

Number and percent of Children performing at a continuum of expressive and receptive language development rates, pre and post treatment; N=51.

Pre Treatment, October '81

Rate		→ .10	→ .20	→ .30	→ .40	→ .50	→ .60	→ .70	→ .80	→ .90	→ .100
Expressive Language	#	3	16	11	10	7	4	0	0	0	0
	%	5.8	31.4	21.6	19.6	13.7	7.8	0	0	0	0
Receptive Language	#	1	11	13	11	7	3	3	1	1	0
	%	1.9	21.6	25.5	21.6	13.7	5.8	5.8	1.9	1.9	0
Post treatment, May '82											
Expressive Language	#	4	11	13	6	8	5	2	1	1	0
	%	7.8	21.6	25.5	11.8	15.7	9.8	3.9	1.9	1.9	0
Receptive Language	#	2	9	11	8	4	10	2	2	0	2
	%	3.9	17.6	21.6	15.7	7.8	19.6	3.9	3.9	0	3.9

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Chart #2

Pre and Post Treatment Rate of Language Development:
[A] Younger than the mean age and [B] Older than the mean age.

A. Subjects younger than the mean age, October '81, (12-32 months)

Pre Treatment, October '81, N=25

Rate		→.10	→.20	→.30	→.40	→.50	→.60	→.70	→.80	→.90	→.100
Expressive Language	#	0	4	6	8	5	2	0	0	0	0
	%	0	16	24	32	20	8	0	0	0	0
Receptive Language	#	0	4	4	7	5	2	1	1	1	0
	%	0	16	16	28	20	8	4	4	4	0
Post treatment, May '82											
Expressive Language	#	0	3	7	4	4	4	2	0	1	0
	%	0	12	28	16	16	16	8	0	4	0
Receptive Language	#	0	3	5	3	4	4	2	2	0	2
	%	0	12	20	12	16	16	8	8	0	8

B. Subjects older than the Mean age, October '81 (33-52 months)

Pre Treatment, October '81, N=26

Expressive Language	#	3	12	5	2	2	2	0	0	0	0
	%	11.5	46.2	19.2	7.7	7.7	7.7	0	0	0	0
Receptive Language	#	1	7	9	4	2	1	2	0	0	0
	%	3.8	26.9	34.6	15.4	7.7	3.8	7.7	0	0	0
Post treatment, May '82											
Expressive Language	#	4	8	6	2	4	1	0	1	0	0
	%	15.4	30.8	23.1	7.7	15.4	3.8	0	3.8	0	0
Receptive Language	#	2	6	6	5	0	6	0	1	0	0
	%	7.7	23.1	23.1	19.2	0	23.1	0	3.8	0	0

Chart #3

Spread of Pre and Post Treatment Rates of Development for:
[A] High motivation group, N=14, [B] Moderate motivation group, N=19,
[C] Low motivation group, N=18

A. High motivation, N=14 Rates	→.10	→.20	→.30	→.40	→.50	→.60	→.70	→.80	→.90	→.100
Pre Treatment, October '81										
Expressive		1	2	3	5	3				
Receptive			1	4	3	2	2	1	1	
Post treatment May '82										
Expressive			2	1	6	3	1	1		
Receptive					3	7	1	2		1

B. Moderate motivation N=19 Rates	→.10	→.20	→.30	→.40	→.50	→.60	→.70	→.80	→.90	→.100
Pre treatment, October '81										
Expressive	1	7	3	6	1	1				
Receptive		4	5	6	2	1	1			
Post treatment, May '82										
Expressive	1	3	6	4	1	2	1		1	
Receptive		1	6	6	1	3		1		1

C. Low motivation, N=18 Rates	→.10	→.20	→.30	→.40	→.50	→.60	→.70	→.80	→.90	→.100
Pre treatment, October										
Expressive	2	8	6	1	1					
Receptive	1	7	7	1	2					
Post treatment, May '82										
Expressive	3	8	5	1	1					
Receptive	2	8	6	1			1			

Chart #4

Spread of Rates of Language Devleopment for 22 Subjects in programs during the year prior to the research

DATE	RATE	→.10	→.20	→.30	→.40	→.50	→.60	→.70	→.80	→.90	→.100
10-80	Expressive	2	6	5	5	3			1		
	Receptive	1	3	7	4	5	1		1		
5-81	Expressive	2	9	3	3	2	2	1			
	Receptive		7	5	5	2	1	1	1		
10-81	Expressive	2	8	5	3	2	2				
	Receptive		6	7	4	1	2	1	1		
5-82	Expressive	2	7	6	2	3	2				
	Receptive		6	7	3	1	4				1

Discussion

Before considering conclusions, the results of the study and the circumstances of the project need further discussion.

Initially four agencies agreed to participate in the project. Agency staff determined the children who would participate. Parents signed consent forms. Final program decisions were made by those responsible for the children's educational programs (participating staff).

Several limitations need to be delineated. One was that in several sites, administrative approval was obtained but staff who would work directly with the project were not notified until the Research Director appeared. Since sites did not want research staff in schools before official approval for the grant was released (after school had started), no time existed for the Research Director to contact direct staff. This slowed acceptance of the project and made cooperation more difficult to obtain.

Another limitation was due to staff turnover. When new speech therapists or teachers began, there was the natural period when they had to learn their new roles and get to know their new students. Again this interfered with cooperation and implementation of suggested activities.

A third limitation was the result of dissatisfied staff. Some were displeased with their class assignments and did little more than necessary, and some were actively seeking career or placement changes. These participating staff persons were less than actively cooperative.

These factors decreased the degree to which suggested activities were implemented and perhaps had some effect upon the results.

The above discussion is not intended to say cooperation or active consideration and implementation of suggestions did not occur. They did, and for the

most part, to an acceptable degree, but the discussed problems did influence the results.

Another factor which must be considered when examining the results is the nature of the participating children. As stated in the Results Section, the mean age of the children as of October 1981 was 32.23 months, the mean level of development in expressive language was 8.89 months and in receptive language was 10.89 months. Most children were multiply handicapped with physical involvement. The physical handicap limited their active interaction with the environment. This made them were fairly passive in initiating interaction, that is, less active in seeking or demanding contact with objects and people.

This necessitated that expressive language programs focus on 2 areas: 1) the development of initiating behavior and 2) the development of responding behavior (elicitation of responses).

Programming to encourage initiation required modification of activities in the Activity Guide. This was done by task analyzing activities. Progress in initiating behaviors was not reflected in standard language evaluations, so do not register in the data. More sensitive measures were needed.

Discussions with participating staff indicated the lack of initiating behavior is a pervasive problem in teaching severely handicapped children. A stated goal throughout programs was to help the children eventually become competent communicators - expressing their desires, needs, preferences and thoughts as well as responding to other peoples' initiated communication. Since this was a common goal and problem expressed by educators, a small pilot study (sub-study of the main project) was conducted in order to investigate present solutions attempted by staff. This study is reported in Appendix B and indicates a need for further study and strategy formation to more systematically address the problem.

The second area of focus for expressive language programs was to develop response behaviors. This involved encouraging appropriate responses to stimuli; or in other words, expressive language was elicited. These goals were more directly addressed in the Activity Guide and are reflected by standard language evaluations.

Therefore half the expressive language goals required task analysis of activities in the Activity Guide, plus are not reflected by standard evaluation. Some activities to encourage and facilitate initiation of behavior are now included in the Activity Guide but this means that these efforts made by staff and these gains made by certain children are not reflected in the research results.

The analysis of data showed several significant ($p. < .05$) results. Overall, the population made significant ($p. < .001$) gains in their rate of expressive and receptive language development. Subjects with relatively higher motivation made significantly ($p. < .001$) more gains that those with lower motivation. And there was the tendency for younger subjects to make more gains than older subjects.

The research occurred within total educational programs. It is very difficult to separate the influence of the Activity Guide and the Research from the total programs. One attempt to do this was the comparison of gain made during the research year with gains made the prior year. They made more gains in rate of development during the research than during the prior year ($p. < .08$).

Changes in their rate of development were negative during the prior year and were small but positive during the research year.

The above results are believed to indicate that within a total educational program, utilization of suggestions in the Activity Guide had positive effects

and contributed to the overall significant gains made by the population in their rate of language development. Several alternative explanations are also possible. These are discussed below.

1. The participating staff may have been more experienced during the project year than during prior years, and therefore better at implementing programs. But no particular training occurred between years, and staff expressed interest in the project and stated needs for more information on augmentative communication strategies. These factors tend to decrease the likelihood of this explanation.

2. A Maturation factor may have contributed to the significant changes. This factor was addressed when the past performances of 22 children were examined and could not be ruled out. Maturation probably did influence the gains; but with the population of severely handicapped children, rates of development tend to decrease over time. Since this research was a part of the total program which resulted in positive and significant increases in rate of development, it is believed that maturation did not contribute much to these results.

3. Another alternative explanation could be that only the total program offered by participating sites contributed to the positive changes. The Activity Guide and the research effort were intended only to supplement language programs. Many suggested activities were implemented. The project contributed to the total programs offered, and therefore became a part of those programs. It is highly likely that the total program contributed strongly to results. It is also true that the research project was a part of these total programs.

4. Perhaps the Research Director effected the changes rather than the Activity Guide. This may have occurred since with his presence more attention was directed to language programs. It is assumed that the Research Director did influence programming and staff learned new strategies from their direct in-

volvement with his as a consultant. Perhaps the implication is that we cannot expect written works to "do it all." Staff learned concepts in the Activity Guide from the Research Director. The relative influences cannot be separated.

5. The changes in the children's rate of language development may have been the result of a regression to the mean. The data from the 22 children who were enrolled in programs prior to the research year refute this explanation. Examining their scores over time indicates that no regression to the mean occurs. The factor does not appear to apply to this population.

Conclusions

The study was conducted throughout the 1981-82 school year. Four agencies participated and 51 children completed the year in the project.

The primary purpose was to field test Activities to Facilitate Nonvocal Language - Communication Boards with children between birth and 4½ years of age who had a poor prognosis for speech development. Objectives and research questions are stated in the Introduction. Following are the conclusions of this study:

1. The objective to field test the Activity Guide was met. There were some difficulties with staff cooperation as discussed in the preceding section.

2. Teachers, therapists and parents were provided with ongoing ideas, suggestions and materials directed toward facilitating augmentative communication development. This objective was achieved.

3. It is believed implementation of the Activity Guide within a total education program made a positive contribution to the significant ($p. < .001$) change in the rate of expressive and receptive language development for the participating children. Although the change in the rate of development during the project year compared to the prior year was only at the $p. < .07$ level, the

positive direction lends support to this conclusion. Factors such as the insensitivity of measurement instruments and occasional poor cooperation are believed to have muted the observed effects.

4. Children with a higher motivation to interact (as determined by initiating behavior) made significantly (p. / .001) more gains in rate of development than children with a lower motivation. These children were also performing at a higher rate of development. This leads to the conclusion that children who appear more motivated to initiate behavior and who have higher rates of development are more likely to benefit from programming. These conclusions lead to the belief that increasing motivation or increasing initiating behaviors are extremely important goals if total programming is to be successful. More research and strategy development is needed in this area. Programs directed toward milestone development do not address this crucial factor. Severely handicapped children need more programming with the goal of increasing initiation.

5. More research is needed to firmly establish the value of introducing augmentative communication programming to very young children who have poor prognosis for developing speech. If studies are carried out with severely handicapped students or poorly motivated students, more sensitive measurement devices are needed. Perhaps studies with a few children might be better able to document changes in initiating behavior through repeated observations.

Also, more research is needed to develop strategies which facilitate prelinguistic behaviors as precursors for augmentative communication systems and to develop easier means for severely handicapped children to communicate as language emerges.

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APPENDIX A

Sample Communication Profiles

Communication Profile - Sample 1

Child Name:

Date of Birth:

Chronological Age: 30 months

Date:

Standard Evaluation:

7-8-80 REEL at C.A. 15 mo.
Exp. 6 mo. Rec. 8-9 mo.
5-5-81 REEL at C.A. 25 mo.
Exp. 12-14 mo. Rec. 16-18 mo.
10-20-81 REEL at C.A. 30 mo.
Exp. 12-14 mo. Rec. 27-30 mo.

5-81 E-LAP at C.A. 25 mo.
Cog. 16-18 mo.
Soc. 16-18 mo.
10-81 E-LAP at C.A. 30 mo.
Cog. 24 mo. plus scatter
Soc. 16-18 mo.

Grant Evaluations 10-20-81
Motivation Questionnaire 83 High motivation
Criterion Reference Instrument 70 Ready for communication system

Present Communication

Name is demonstrating receptive language skills near her 30 month C.A. She is highly motivated to interact with her environment (both object and social). Presently communicates by using a variety of means: she solicits adult help by pointing and vocalizations, demonstrates an age appropriate reliable yes/no and uses several word approximations. Understanding of speech attempts is limited due to severe oral motor involvement. Communications generally revolve around needs and

wants (i.e., thirst, come, play, yes or no to choices, and becomes frustrated when not understood). Impression - ready for introduction to augmentative communication/interactive systems.

Suggestions for Programming

Two aspects of programming will be addressed: 1) modification of environment for immediate expansion of communication and 2) clinical aspects of developing skills to be used in the future for communication.

First, is presently communicating by using gestures and vocalizations. Vocalizations need to be encouraged by responsiveness to message and by modeling slightly expanded examples (ex.: says "bow"for bottle, adult responds to request by modeling "You want a drink from your bottle" and appropriate action, maybe getting bottle or cup or saying "as soon as I'm off the phone I'll get you a drink). Also uses gestures to indicate wants. This needs to be made more specific. Use her present skills so that success is more likely and she gets expanded control while communicating. Examples might include the following: for drink - put pictures of possible favorites on refridgerator so when request is made a choice must follow; choices in routine: bed time - pajamas or teeth brushing first, one of two stories, meals - eggs or cereal, peanut butter and jelly or lunch meat sandwich; play - ball or dolls or puzzles, in chair or on floor; dressing - which shirt; allow appropriate rejection of suggestions; and some modeling with pictures should start.

Second, programming goals need to be established to build skills to be used in communication. The follwoing are some ideas: 1) continue object and picture discrimination goals, 2) use pictures to answer questions such as with cup and picture ask "What is this?", response point to picture,

3) use gestures to answer questions in a similar manner, 4) use pictures as to their use example: "What do you use to get a drink?", 5) use objects and pictures to model communication example: with doll, cup, chair, spoon, brush and pictures of cup, chair, spoon, and brush pretend the doll is thirsty, for doll to get drink she must point to picture of cup. In other words, tell stories or act stories with use of nonvocal communication. 6) allow gestural communication to choose clinical activity example: fine motor activity or stories for communication.

Also needed is continued programming to develop motor (gross, fine, oral) skills, cognitive skills and specific skills which may be used in communication (positions, adaptations, methods of indicating).

Materials

Besides those mentioned above, materials might include several pictures about one topic mounted on a card (example: foods, toys, people). Also a communication board (wheelchair, tray or easel) could be used to display pictures, toys and objects. This may serve as a preliminary communication board as skills develop.

Communication Profile - Sample 2

Child Name:

Date of Birth:

Chronological Age: 24 months

Date: October '81

Standard Evaluation:

10-1981 Early LAP Exp. and Rec. 1-3 mo.
REEL Exp. and Rec. 1-3 mo.

Grant Evaluations
Motivation Questionnaire 13 (low)
Criterion Reference Instrument 5

Present Communication

Is extremely physically involved so therefore very limited in movement. She's visually impaired, she is primarily passive to her environment. Her primary means of social interaction is through eye contact, some reaching for her mother's face and crying. Her mother reports she has two crys: 1) when she is upset and 2) when fussy situation differences include: 1) before 1st feeding, 2) when needing a diaper change. She will look at toys presented and tracks horizontally. Favorite toys are Turner Learner and T.V. to which, she smiles and giggles, displays displeasure when her mother leaves by "pouting" with lower lip pushed out.

Program and Material Suggestions

Needs continued programming to facilitate normal muscle tone and movement and continued vision training. At her early stage of sensori-motor development she needs continued responsiveness to social uses. This includes: social response to crying, fussy behavior, eye contact, reaching toward face, pouting,

object (toy, T.V.) connected smiles and giggles. When in a good position she needs lots of graded physical contact to elicit responses

Also needs some way to begin impacting on physical environment. Investigation to find toys which interest her should continue. They then need to be modified so she can be facilitated to activate. Battery toys which include sounds and light should be sampled. These usually can be modified with simple switches.

Auditory localizaiton and tracking should also continue.

APPENDIX B

Sub-study

Appendix B

(Report of the Sub-study - James Helm, Project Director)

Exploratory Study: Communication with nonspeaking students

The idea for this study originated from discussions with participating program staff. They repeatedly expressed one frustration: Many nonspeaking (or minimally speaking) students tended to be very passive; they initiated very little communication.

Staff wanted to help these students toward becoming competent communicators. Competent being defined as expressing needs, desires and thoughts as well as responding to communication directed at them. Staff understood full realization of this goal was unlikely for many students, but they were frustrated by a lack of communication initiation.

This investigator decided to pursue the problem further. An exploratory study was planned in order to examine the problem. More information was needed concerning the present communication milieu of these students. It was decided that the investigator would observe classes with nonspeaking children and begin to develop a means for evaluating the communication systems which exist between students and teachers.

Approval was obtained from school administrators, teachers and staff, Short observations were arranged. They lasted between 15-30 minutes. A variety of classes and activities were observed in 9 classes at 4 sites. A total of 16 observations were made.

During an observation the investigator attempted to record all communication related behavior. Activity falling under this discription expanded as observations continued. Observation notes were later transcribed and the preliminary coding system developed.

The system codes who initiates interaction in what way, concerning what topic and in what context. Then responses are coded in a similar fashion. Other factors are also coded; they include: emotion, manner of behavior, interruptions, etc.

The study was exploratory with primary purpose of determining if this method might be productive. It appears much information can be obtained through this participant observation technique. Many more observations of longer duration would be needed to more fully develop the coding systems and to discover general patterns.

The only general findings which can be reported now are the following. Students did appear to initiate many of the adult-student exchanges. Teachers responded to a wide variety of behaviors. One most noteable observation was that teachers often could not understand what, if anything, was intended by the student. Behavior readability was low. This responsiveness by teachers did appear to encourage more behavior. To reiterate, these findings are preliminary. More research is needed to further develop the techniques and coding system, to discover communication patterns and any implications which can be made.

This research appears to be needed and desired by the field.